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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service, National Institutes of Health

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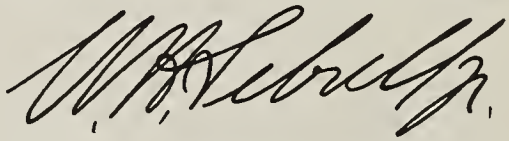
THE NATIONAL INSTITUTES OF HEALTH, a bureau of the Public Health Service, supports medical research and training in the Nation's medical schools, universities, and other research centers. It also conducts laboratory and clinical research in its own facilities at Bethesda, Maryland, and in the field.

The programs of the seven Institutes are designed to obtain new medical knowledge in order to control especially the major killing and crippling diseases of today, such as cancer, heart disease, arthritis, neurological disorders, and mental illness. The role of medical science in promoting better health and longer life is well recognized by the American people. Only through continued research leading to increased understanding of the causes, prevention, and treatment of disease can we become a healthier and stronger Nation.

We at the National Institutes of Health appreciate our great responsibility. We approach our work with humility, but with confidence that we can aid materially in man's conquest of disease.



W. H. Sebrell, Jr., M. D.,
Director, National Institutes of Health.

Growth and Progress

At the beginning of this century, the average newborn child in the United States could be expected to live only 47 years. Today the average life span is over 68 years. The principal reason for this gain has been the progress of medical science, particularly against infectious diseases.

Among contributing agencies has been the Public Health Service. Since its creation by Congress in 1798, this organization—first named the Marine Hospital Service—has shouldered a steadily increasing responsibility. Today its various services and facilities, such as those of the National Institutes of Health, form an important part of the Nation's public health resources.

The Service has conducted medical research since 1887, when a laboratory of bacteriology was established on Staten Island, N. Y. This was in response to the urgent need to guard against epidemics that might arise from persons entering the country. Dr. Joseph J. Kinyoun, director of the new laboratory, was the first to detect the cholera organism among immigrants to America.

The leading causes of death at that time were infectious diseases—pneumonia and influenza, tuberculosis, intestinal disorders. But those were also the days of Pasteur, Koch, and Ehrlich. They were days of discoveries that offered not only effective health weapons, such as diphtheria antitoxin, but also basic principles that launched an era of great progress in medical science.

From the Public Health Service's laboratories, now centered largely in the National Institutes of Health at Bethesda, Md., have come knowledge and techniques that made possible the control of many communicable and nutritional diseases. Illustrative advances are the recognition that pellagra results from a dietary deficiency; the development of a vaccine and serum against Rocky Mountain spotted fever; vaccines for typhus and mumps; and the discovery of several diseases—ariboflavinosis, Louisiana pneumonitis, rickettsialpox.

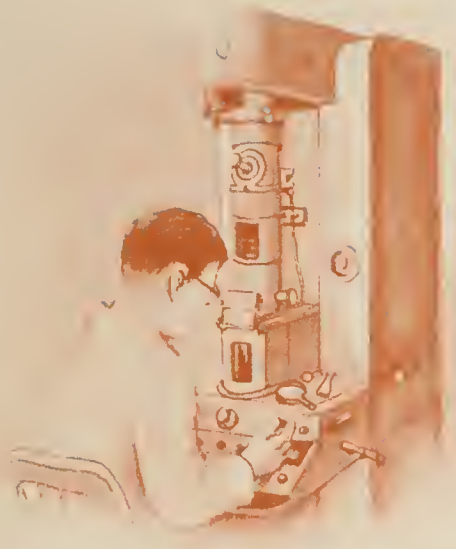
Before World War II, major trends were apparent in the Nation's health. Sanitation, better nutrition, improved medical treatment had all contributed to longer life; and more people were subject to the ills of an aging population—the so-called chronic diseases. Their control would require new knowledge, new basic principles that only research could provide.

Accordingly, Congress authorized in 1937 the National Cancer Institute, dedicated to research against the disease that had risen from eighth to second place as a cause of death in this country. For five years after the war, the scope was extended. Six additional research Institutes, some incorporating older laboratories, were established at Bethesda, each to work in a problem area such as heart disease or mental illness.

The Institutes were organized not only to conduct research, but also to support research projects, fellowships, training, teaching, and the construction of research facilities in America's universities and medical institutions. A Division of Research Grants was established at the National Institutes of Health to coordinate and expedite the grants and fellowships.

In 1953 the Clinical Center, a 500-bed facility for clinical-laboratory research, was opened at NIH, enabling all the Institutes to increase their study of patients and rounding out their programs.

1798	President John Adams signs bill establishing Marine Hospital Service for merchant seamen.
1887	Research laboratory is founded at Marine Hospital, Staten Island, N. Y., to meet new responsibilities of Service.
1891	Hygienic Laboratory moves from Staten Island to Service headquarters, Washington, D. C.
1902	Advisory Board for the Hygienic Laboratory established; later to become National Advisory Health Council.
1912	Name of Public Health & Marine Hospital Service changed to Public Health Service.
1930	Hygienic Laboratory becomes National Institute of Health.
1937	Congress authorizes National Cancer Institute.
1938	National Institute of Health moves to land donated by Mr. and Mrs. Luke I. Wilson at Bethesda, Md.
1947	Division of Research Grants established to process NIH grants and fellowships to non-Federal institutions and scientists.
1948	National Heart Institute authorized; other laboratories regrouped to form Microbiological Institute, Experimental Biology & Medicine Institute, and National Institute of Dental Research. NIH becomes National *Institutes* of Health.
1949	Mental hygiene program of Public Health Service transferred to NIH and expanded to become National Institute of Mental Health.
1950	National Institute of Neurological Diseases & Blindness and National Institute of Arthritis & Metabolic Diseases established, the latter absorbing Experimental Biology & Medicine Institute.
1953	Public Health Service becomes a constituent of newly created Department of Health, Education, & Welfare; Clinical Center opens.



Medical Research Today

As medical science advances, it must deal with ever more subtle problems. True, the problems of yesterday were no less difficult then; but a real change has occurred in the scientist and his approach. Knowledge has grown so vast that today's scientist must be a specialist, and in order to draw from other specialties, he must often work in a team. Moreover, the complexity and precision of his equipment have necessarily increased. It is because of these trends that medical science today requires coordination, special training, and research centers like the National Institutes of Health.

Two studies in immunology will illustrate this growing complexity. In 1900 physicians faced a serious problem in the use of serums for immunization. Some patients when given antitoxin against diphtheria or tetanus reacted violently, and there were occasional deaths. At first these effects were blamed on the dangerous organisms with which the serums were made. But two scientists of the Public Health Service, Drs. Rosenau and Anderson, showed in 1906 that serum without antitoxic properties would produce such reactions in guinea pigs, if injected twice. In other words, the first injection produced a sensitivity to the serum: the animals were then "allergic."

A simple experiment had led to a major practical discovery. It became the rule to test the patient's response to serum before giving a full dose. Furthermore, the scientists were soon able to state the important principle that allergy to a foreign substance in the body—serum, pollen, sometimes certain foods—results from the formation of antibodies, and is thus related to the process of immunization against infectious organisms. The new concept of allergy greatly extended the science of immunology.

Today, allergy still presents many mysteries. Why are some people allergic, hypersensitive, to certain substances? Is allergy responsible for some diseases of unknown origin? In the National Microbiological Institute, current studies seek to determine whether rheumatic fever is an allergic reaction and to identify the sensitizing agent. Rheumatic fever, a major cause of heart damage, is usually preceded by a streptococcal throat infection, and the time lag between the conditions suggests that antibody formation is involved.

The problem of these scientists is to learn which fraction of streptococcus, among 40-odd types of the organism, may act as the sensitizing agent, the antigen. The techniques used in the study are varied and delicate. Conclusions cannot yet be drawn, nor all the difficulties anticipated. These lie beyond the frontier.

The increasing subtlety of medical problems is marked by another trend: the rise of new scientific specialties, or disciplines. Early in the history of medicine, the study of anatomy was paramount. The resulting knowledge of the body's structure permitted systematic investigation of its functions—physiology—and of the changes wrought by disease—pathology. Against the background of these disciplines and chemistry arose the modern study of drugs, or pharmacology . . . and so it goes. Since World War II, the most rapidly emerging discipline has been biochemistry, a formidable supplement to the classical approaches.

Biochemistry seeks knowledge of the chemical reactions underlying the body's functions in health

and disease. Like pathology, it may be regarded not only as a specialty, but as an approach applicable in many fields—microbiology, pharmacology, neurology, chemotherapy, nutrition. The rise of biochemistry in medical research has resulted from two general conditions: a growing need and the availability of technical means.

The chronic diseases, such as cancer, arteriosclerosis, arthritis, and schizophrenia, require new knowledge of body processes in which chemistry is involved. In cancer, for example, science is dealing with fundamental aspects of growth. Arthritis is known to be temporarily relieved by hormones, the body's chemical messengers. In the neurological disorders—epilepsy, cerebral palsy, multiple sclerosis—damage has occurred in the body's system of control and communication. To cope adequately with such problems, we must explain them in chemical terms.

Means for doing so have been developed in recent years. An important tool of the biochemist is the Warburg apparatus, which enables the scientist to measure the activity of enzymes—natural accelerators of chemical reactions in tissues. A technique more recently applied is chromatography. This is used to separate various substances, such as the components of protein. Tracer studies with radioisotopes, byproducts of the wartime atomic development, constitute a third technique, the value of which could hardly be exaggerated.

Isotopes are employed in the study of metabolism—the body's use of foods as fuel and building materials to carry on life. Compounds are prepared in which the radioactive isotope of an element, such as carbon or iodine, is substituted for the natural form, enabling the scientist to trace the metabolism of the compound by means of a Geiger counter. Tracer and therapeutic uses of radioiodine, I^{131}, are illustrated by current experiments at the National Cancer Institute. In adequate doses, I^{131} can destroy thyroid tissue, and is therefore useful against some types of thyroid tumor; but other types lack capacity to take iodine from the blood. This problem and the genesis of cancer are being studied by tracing the uptake of I^{131} as chemically induced tumors develop in the thyroids of mice.

Research in metabolism, though often applied to a specific health problem, is gradually building toward an over-all view of body chemistry. For example, much progress has been made in mapping the numerous steps by which sugar in the body is converted to a usable form and finally burned to yield energy. Then, the means by which energy is harnessed are also being investigated. Such mechanisms involve vitamins, minerals, enzymes, and other substances. Intricate indeed is the jigsaw puzzle of metabolism, normal and abnormal; and a complete solution, certainly far in the future, would leave few mysteries of disease.

Biophysics, the science of matter and motion as related to life, is another expanding discipline that serves many fields. Again, new equipment and techniques have played a major part. For example, the electron microscope, about 100 times as powerful as earlier instruments, has extended the visualization of tissues to their smallest units, the molecules themselves. The ultracentrifuge, a high-speed whirling device, separates the particles composing cells. Other instruments that have opened new approaches are those used in the study of radiation, such as generators of subatomic particles in the multimillion-volt range.

Medical research today, as typified at the National Institutes of Health, requires not only competent scientists, but also supporting personnel and facilities. The investigators who plan and conduct research are aided by teams of trained assistants. Serving the Institute laboratories are such auxiliary departments as the centralized instrument shop, animal production colony, and scientific library. There is an organization for the maintenance of facilities and grounds. Finally, an administrative staff provides over-all coordination and management; and these elements together must constitute an environment conducive to creative effort.

The trends described above are merely illustrative; they do not give a rounded picture. Other emerging specialties include psychiatry, the social sciences, biostatistics. And long-established disciplines—surgery, endocrinology, genetics, and others previously mentioned—are more productive than ever. A rounded picture would also show the integration of various levels of study—the "test-tube stage," animal investigation, and clinical research.

But all types of medical research conducted today are represented at the National Institutes of Health and in the laboratories of its grantees. A broader picture is offered in the pages ahead.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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CLINICAL CENTER
NATIONAL INSTITUTE OF DENTAL RESEARCH
NATIONAL INSTITUTE OF ARTHRITIS & METABOLIC DISEASES
NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES & BLINDNESS
DIVISION OF RESEARCH GRANTS

National Microbiological Institute

Infectious disease research is the oldest activity of the National Institutes of Health. In recent years the science of microbiology has shifted in emphasis and approach to meet new problems and to utilize newly acquired knowledge.

Although striking gains have been made against infectious illnesses, particularly the bacterial diseases, serious problems remain unsolved. Our knowledge of the viral diseases, for example, is inexact and fragmentary. Some of them, especially those of the upper respiratory tract, are so poorly understood that we cannot even assemble accurate figures on their prevalence.

At the National Microbiological Institute, the approach to many infectious disease problems is centered in fundamental research. Through biochemical and biophysical studies, scientists seek an understanding of the borderline that separates life from nonlife. They are investigating the structure and functioning of viruses, the smallest substances that can be called "living," and the role of proteins, largest of the "nonliving" molecules. Knowledge gained through such studies has important implications, not only for microbiology, but for all the medical and biological sciences.

Child inoculated in evaluation of newly developed vaccine for influenza

In this work, scientists have been aided immeasurably by new and vastly improved techniques. Prominent among these is the culturing of viruses within tissues living in test tubes. A truly revolutionary tool, tissue culture has initiated a new era in research on poliomyelitis. It permits rapid propagation of viruses without the use of laboratory animals.

The significance of this advance is well illustrated by research on the common cold, a subject of intensive study at the Institute. Here is a problem that has long resisted solution, in part because scientists have been unable to isolate and maintain the causative agent or agents. Tissue culture may at last overcome this major obstacle.

Within the past decade, scientists of these and other laboratories have discovered over 50 viruses in man, though not all are known to cause human disease.

Few advances in microbiology have had greater impact on public health than the antibiotic drugs. Such advances, however, frequently create a host of new problems. Need for critical study of bacterial resistance to antibiotics has followed their widespread use. At the Microbiological Institute, scientists are approaching this problem through basic investigations of the growth requirements and metabolism of bacteria, the mode of action of antibiotics, and many other problems related to resistance and sensitivity.

Some representative diseases studied by the Institute are influenza, poliomyelitis, hepatitis, rheumatic fever, tuberculosis, encephalitis, and brucellosis. Problems range from the clinical evaluation of vaccines to the investigation of allergic factors and host-parasite relationships.

The parasitic diseases, because of their worldwide distribution and their effect on our trade

Weighing and banding chicks in studies of diphtheria toxin-antitoxin

economy, are also under study here. While most of these diseases occur outside the country, a number of them are prevalent in the United States—amebic dysentery, trichinosis, and toxoplasmosis, to name a few. Many parasitic diseases are of particular interest to the military. For example, malaria was a major threat to our troops in Korea until better drugs were developed for treatment. In large part, the evaluation of these drugs in humans was carried out by Institute scientists.

One of the major responsibilities of the Microbiological Institute is to monitor the Nation's biological products. No vaccine, toxin, antitoxin, or blood derivative produced by a licensed pharmaceutical house can be exported, imported, or placed in interstate commerce unless it meets the Federal Government's rigid standards for safety, purity, and potency. In addition to enforcing the regulations, Institute scientists have improved some of these products and discovered others.

To augment research in its own laboratories, the Microbiological Institute supports, through grants-in-aid, biological studies in universities, medical schools, and other non-Federal institutions.

With the opening of the Clinical Center, the Institute initiated a clinical research program that greatly extends the attack on major infectious and parasitic diseases. The latter in particular remain to be adequately explored. Schistosomiasis and filariasis, for example, cannot at present be treated definitively, and even palliative treatment is poor. Clinical investigation of these diseases, which afflict millions throughout the world, emphasizes experimental therapy and the development of better methods of diagnosis.

Progress against the infectious diseases in recent years has been rapid and extensive, and the gains are continuing. In some respects the most challenging advance has been the growing awareness of the relation of infectious diseases to chronic disorders. Some of the latter are known to originate in infections that occur years before. Future progress against these chronic ailments depends in part on better understanding and more effective control of infections earlier in life.

Much of the work of the National Microbiological Institute is in areas that particularly involve children: respiratory diseases, whooping cough, poliomyelitis, diphtheria, toxoplasmosis, and rheumatic fever. Children are still the principal victims of communicable diseases. All too frequently, these afflictions result in chronic illness or invalidism. The Institute strongly emphasises these important and often far-reaching diseases of childhood.

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National Institute of Arthritis & Metabolic Diseases

Some of the oldest laboratories and best known discoveries of Public Health Service scientists are represented by the National Institute of Arthritis and Metabolic Diseases. The Institute incorporates the former Experimental Biology and Medicine Institute containing laboratories of biochemistry, nutrition, pathology, pharmacology, physiology, chemistry, and physical biology. In new areas of research, arthritis and the metabolic diseases are specifically attacked.

The Institute also awards grants to aid research in non-Federal institutions, fellowships to develop research talent, and clinical traineeships for studies in the prevention, diagnosis, and treatment of diseases in the Institute's field.

Laboratories now in this Institute have contributed significantly to the Public Health Service's record of progress. Achievements include the determination of the cause, prevention, and treatment of pellagra and ariboflavinosis; the discovery that oral administration of ordinary table salt dissolved in water holds promise as a mass emergency treatment for shock; and the development of synthetic drugs that make the United States potentially independent of foreign sources of opium.

The establishment of the Institute in 1950 followed a surge of interest in the rheumatic and metabolic diseases, stimulated by the momentous discovery that some arthritic patients are benefited by hormones—cortisone or ACTH. This indicated that hormonal balance and metabolism may be important factors in the cause and development of rheumatic disease. Cortisone and hydrocortisone, hormones from the adrenal glands, and ACTH, from the pituitary, cannot be regarded as curative in rheumatoid arthritis; but they have led to the rehabilitation of thousands and have greatly broadened arthritis research. The Institute is following up many new leads in this study area.

One significant advance by the Institute in this field is a method for detecting and measuring minute amounts of adrenal hormones in body fluids. Accurate to less than a ten-millionth of an ounce, the method is being used to estimate the hormone-producing capacity of the adrenal glands.

Handling ashes of rats that have received radioisotopes in tracer studies of metabolism

A test has been developed which promises to be as specific for rheumatoid arthritis as the Wassermann test is for syphilis. This is being refined and made more sensitive.

By means of radioactive cortisone and other hormones, progress is being made in clinical tests to determine how these hormones are utilized in the body. This is part of a search for a similar anti-rheumatic substance that would produce a minimum of undesirable side effects.

Research on metabolic problems has yielded a bioassay permitting the detection and accurate measurement of minute amounts of insulin in blood. This test is expected to lead to a better understanding of the underlying metabolic disorder in diabetes. Most cases of this prevalent disease can be controlled by diet and insulin, but little is yet known about the cause, and there is no cure.

Although the Institute has made notable contributions to the knowledge of specific diseases, its laboratories are best known for their fundamental research. For example, the laboratory studying the chemistry of sugars has been a leader in this field for a quarter of a century. Physical biologists of the Institute have shared in the development of electron microscopy as a tool for learning how viruses multiply and for exploring the basic structures of cells. The enzymologists have advanced the understanding of complex chemical systems underlying tissue growth and function.

In general, the purpose of research at this level is to extend our knowledge of basic processes of life—knowledge frequently applicable against a specific disease. For example, the discovery that a single dose of gold thioglucose may permanently increase the appetite of a mouse provides a fundamental tool for obesity studies. A vitamin isolated here, the citrovorum factor, has shown promise in the treatment of certain anemias. In many instances, basic research adds to the picture of man's development—his growth, maturity, aging, and death.

In other laboratory studies, endocrinologists are methodically explaining the relation of the glands to the nervous system, especially as regards the metabolic diseases. Nutritionists are seeking new vitamins and determining their role in health, with notable success against degenerative diseases of the liver. Biophysicists are exploring the basic mechanics of respiration, muscle contraction, and other functions, largely under special conditions such as high altitude. Studies in pathology are conducted both as an independent approach and cooperatively with other NIH scientists.

In the Clinical Center, the Institute has developed a program which closely integrates the work of laboratory scientists and clinical investigators. Studies involving patients with rheumatoid arthritis, gout, liver diseases, diabetes, and various other metabolic disorders are under way.

An example of the projects made possible by the facilities of the Center is research on energy and mineral metabolism, utilizing a respiratory chamber. This is a specially equipped room, designed for determining the total energy expenditure of patients tested. To get a complete picture, nutrients and gases consumed are accurately measured, wastes are analyzed, and energy output is recorded. Such research is particularly important to the understanding of obesity.

Projects similar to those described above are supported under the Institute's program of research grants.

The Institute also administers the NIH Isotope Laboratory, in which all the Institutes conduct studies involving hazardous radiation.

Metabolic kitchen for preparing meals in which all ingredients are precisely measured

National Cancer Institute

Each year in the United States, nearly three-quarters of a million people are treated for cancer, and more than half a million of these cases are newly diagnosed. Approximately a quarter of a million cancer deaths occur annually. At prevailing rates, 16 out of every 100 people born are destined to die of this disease.

Cancer is a disease of cells. Once a cell has become malignant, the change appears to be irreversible and the cell reproduces in its new form. Cancers of various organs or tissues are apparently due to different causes, and therefore present different problems in cancer research and control.

The National Cancer Institute is attacking these problems through clinical and laboratory research, epidemiological studies, field investigations and demonstrations, educational programs, and the improvement and expansion of cancer services and facilities.

The search for the causes, means of diagnosis, and cures of cancer involves many scientific specialties, all of which are represented in the broad research programs of the Institute's staff and grantees. Growth processes, hormones, cell chemistry and mechanisms, cancer susceptibility and resistance, tumor-host relationships, nutrition and tumor growth, cancer-inducing and -destroying agents—all these and many more aspects of the problem are studied in an effort to gain the necessary knowledge to conquer this disease.

Injecting tumor-damaging drugs into eggs to measure toxicity by effect on embryos

Surgery and radiation are the only techniques available for curative therapy of cancer. New types of treatment are being explored and more effective ones urgently sought. One goal of cancer research is the discovery of a substance that will destroy the tumor without injuring other tissues. In an effort to find such compounds, Institute scientists have tested more than 3,000 substances for their ability to damage tumors in experimental animals. A few compounds have shown promise and are being studied further.

Much attention is also given to the effects of radiation upon normal tissues and cancer. Therapeutic uses of radioactive substances, the development and evaluation of supervoltage radiation, and attempts to prevent or modify the undesirable side-effects of radiation are important areas of investigation.

Hormones play a role in the development of cancer of certain tissues, such as those of the breast and reproductive organs. Moreover, changes in the hormonal balance of the body will retard some cancer for varying periods. These discoveries have greatly stimulated the study of hormones—endocrinology—as related to cancer growth. Contributions by Institute scientists include the development of new and superior methods of hormonal therapy and the synthesis of new compounds with hormone-like properties. One of these is five times as potent in biological assays as naturally occurring progesterone. Another gives promise of being useful in depressing hormonal secretions from the adrenal cortex.

Analysis of hormones excreted by cancer patients, in typical laboratory of Clinical Center

New leads in the attack on leukemia include the observations that the thymus gland appears to play a role in the development of this disease, that the ability of the lungs to remove white cells from the blood is impaired in leukemic persons, and that antifolic and antipyrimidine compounds together are more effective against experimental leukemia than is either compound alone.

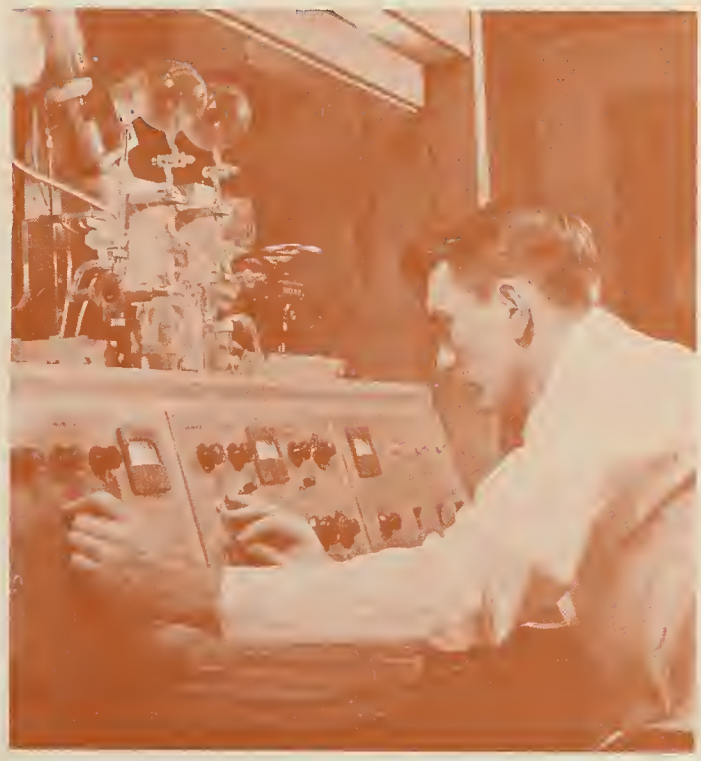
In a large proportion of cases, cancer gives no warning of its presence in internal organs until it has reached an incurable stage. Hence, the Institute conducts and supports many studies of diagnostic tests and case-finding procedures. Progress is being made on tests for cancer of specific sites as well as on a general test. A special area of Institute interest is large-scale field studies of the cytology test, which has proved particularly useful in detecting cancer of the uterus, lung, bladder, oral cavity, and stomach. Newly developed X-ray techniques with the supervoltage machine will make possible the detection of a higher percentage of early lung cancers.

Variations in the prevalence of some forms of cancer have been observed among persons living or working in different environments and among persons of different ethnic groups. The Institute conducts environmental and epidemiological studies in an effort to determine why such variations occur and how they might be prevented.

Improved nursing of the cancer patient is promoted through studies to determine needs and through activities to increase the nurse's ability to handle cancer problems in the hospital and community. Institute staff members conduct conferences and university courses for nurse educators, consultants, and supervisors. Nursing schools are assisted in integrating the subject of cancer into their basic curriculums, and nursing organizations are given consultive service.

Through the application of present knowledge, much can be done to reduce the suffering and deaths due to cancer. The Institute makes grants to the States to help support their cancer control programs and provides them with consultation. The State activities include surveys, studies, demonstrations, and the development and maintenance of cancer services and facilities.

Institute grants-in-aid support extensive educational programs, both undergraduate and graduate, for physicians, dentists, nurses, and other personnel concerned with the diagnosis and treatment of cancer, and thus increase the skilled personnel available to serve the cancer patient. To help keep the public acquainted with facts about the disease, the Institute utilizes publications, films, exhibits, and other educational media.



Separating isotopes with a mass spectrometer in research on turnover of tissue components

National Institute of Mental Health

The function of this Institute, one of the major focal points of a national effort, is to gain knowledge about the causes of mental and emotional illness, to provide more effective treatment for such disorders, and to promote sound mental health.

Mental illness costs the Nation well over a billion dollars a year, and the figure is increasing annually by 100 million dollars. In addition to the million persons treated each year in mental hospitals, over 100,000 are seen in mental hygiene clinics, child guidance centers, and private psychiatric practice. Mental and emotional disorders account for about half the hospital beds in use throughout the country, and for more than 40 percent of the discharges for disability during World War II.

Some of the more serious mental illnesses are schizophrenia, manic-depressive psychoses, involutional melancholia, senile psychoses, and paranoia. The psychoneuroses, though they generally do not require hospitalization, prevent the fulfillment of normal potentialities. Emotional disturbances often give rise to physical illnesses—the psychosomatic diseases. In addition, emotional problems are responsible for much self-destructive or antisocial behavior, such as alcoholism, suicide, homicide, delinquency, and drug addiction.

Examining electrical record of convulsant activity in brain of a monkey

The shadings between mental health and illness are subtle. Good mental health is not simply the absence of disease, but adjustment to the world and to other people, with maximum effectiveness. The goals of this broad concept were envisioned by Congress in 1946 when the National Mental Health Act was passed. This provides for the training of psychiatric personnel, the expansion of community mental health services, and the conduct and support of research programs.

Many additional men and women are acutely needed in the psychiatric specialties, to staff the required mental health facilities and to do the research necessary to find cures.

The National Institute of Mental Health therefore awards grants to institutions throughout the country to expand their programs for the training of psychiatrists, clinical psychologists, psychiatric social workers, psychiatric nurses, and personnel with knowledge both of public health methods and mental health principles. The Institute also awards traineeships to students who wish to follow mental health careers and fellowships to promising young scientists. In addition, it supports training seminars for the orientation of persons already in practice, and holds conferences to improve professional standards and education.

States are assisted in expanding their mental health programs through technical consultation and services, and through grants for the establishment of mental hygiene clinics, preventive programs in the schools, and other activities. Programs are now under way in all States and Territories, with more than 1,200 child guidance and adult clinics in operation.

The Institute conducts studies to find new approaches to such growing problems as juvenile

On children's ward, a scientist and nurse observe behavior while participating in group activity

delinquency, psychological aspects of aging, and rehabilitation of the mentally ill. In addition, staff members are frequently requested to give technical advice. These consultations have concerned such matters as civil defense and other disaster relief, promotion of mental health programs in schools, preparation of educational materials, and orientation of allied workers including nurses, teachers, lawyers, and ministers.

The Institute meets requests for personnel skilled in hospital administration to survey and advise on State mental hospital systems. It assists in collecting data about the mentally ill, develops programs for rehabilitating patients, and serves as a clearinghouse for information on mental health developments throughout the country.

Man's physical nature is much better understood than his mental and emotional processes. The fundamental causes of the major mental illnesses are not yet known, and scientists agree that a broad spectrum of research must be conducted, from studies on the anatomy of the brain to those on interpersonal experiences of the child and adult. They believe that answers will lie in a complex interaction of biological, psychological, and social factors.

Through its programs of research, the Institute of Mental Health is providing much-needed information. Laboratory investigations are focused on the anatomy, physiology, and biochemistry of the brain and central nervous system; on psychological processes and functions; on the healthy growth and development of children. Clinical studies are concerned with the origin and symptoms of various mental problems—particularly schizophrenia, destructive activity in children, psychosomatic disorders, and aging. Other projects include a long-term study of drug addition, at the Public Health Service Hospital in Lexington, Ky.

The research grants program of the Institute is aiding similar investigations by non-Federal scientists. The funds support fundamental and applied research. Some of the subjects under study are the endocrine and nervous systems, genetics of mental illness, human and animal behavior, relations between social stress and mental disorders, and the efficacy of community-wide programs. In addition, career-investigator grants assist qualified scientists in planning and conducting long-term programs of psychiatric research.

Unprecedented opportunities are available today, through the efforts of government, private foundations, and voluntary agencies, to do productive work in the challenging field of mental health.

National Heart Institute

Separating enzymes by filter-paper electrophoresis in research on arteriosclerosis

Diseases of the heart and blood vessels cause approximately half of the deaths in the United States. The heavy impact of this problem is felt not only in loss of life, but also in disability, suffering, and extensive economic loss. Heart disease claims many of its victims prematurely, in their most productive years. About 10 million of our people have cardiovascular afflictions, and there are relatively few effective therapies. New knowledge must come from research. To help meet this serious national problem, Congress in 1948 established the National Heart Institute.

The research program of the Institute develops knowledge pertinent to an understanding of the structure, function, and abnormalties of the cardiovascular system. Understanding fundamental processes of a disease is the surest road to better means of countering it.

The Institute scientists attack a wide range of problems and apply a variety of disciplines. One area of activity is research in the chemistry of natural products, concerned with naturally occurring compounds of physiological importance. For example, a compound that depresses blood pressure in experimental tests has been isolated from the rhododendron plant and is now under laboratory and clinical study.

Investigators in cellular physiology and metabolism are attempting to translate to a cellular or organ level the advances made in the general field of enzyme chemistry and biophysics. The means by which cells utilize the chemical energy of foodstuffs for such processes as muscular contraction are studied, as are the factors implicated in the development of atherosclerosis, the major form of hardening of the arteries.

Pharmacological research is aimed at the development of better drugs for the treatment of diseases of the heart and blood vessels. For example, studies of the pathways by which drugs are broken down in the body permit the design of drugs for specific purposes, such as an anesthetic that loses effect as soon as administration is stopped—a highly desirable feature in surgery on elderly and cardiac patients.

The study of medical physiology is concerned with such matters as the mechanisms by which blood vessel size, and thus blood pressure, are regulated, and with factors related to the distribution of important salts in the body. In studies of kidney function, a recent accomplishment is the demonstration that the failure of salt excretion by the kidney, which leads to edema (dropsy) in heart failure, involves an increase in the activity of the adrenal glands.

Technical developments are providing a number of useful devices for the detection, diagnosis, and study of disease by physical means, and for the facilitation of laboratory and clinical research.

Studies are being conducted on the physiological, biochemical, and psychological changes that take place in aging people. One technique for evaluating the effects of aging on blood vessels walls is

based upon the capacity of these vessels to transmit an externally applied impulse.

Institute research in surgery seeks to improve surgical procedures for the correction and alleviation of disorders of the heart and blood vessels. Great strides have recently been made in this field, and many potentialities remain.

In general medicine and experimental therapeutics, new techniques, instruments, and drugs, some of them developed in laboratories of the Institute, are being evaluated, with emphasis on hypertension (high blood pressure).

Laboratory investigations are the foundation of heart research and demand the greatest part of the work. Clinical application, however, is the topmost stone of the pyramid. The facilities of the Clinical Center provide the opportunity to carry significant work to actual clinical trial, with minimum delay. The Heart Institute also conducts or participates in research at various hospitals.

In addition to its laboratory and clinical research at Bethesda, the Institute is conducting a long-term community study at Framingham, Mass. This may provide definite information as to what characteristics are present in people who develop heart disease. The project involves a detailed physical reexamination every 2 years of over 5,000 adults between the ages of 30 and 60.

Other important parts of the Institute's attack on heart disease are the extensive program of grants for research in universities and hospitals, and training programs of three types—research fellowships, clinical traineeships, and teaching grants to medical schools. Other functions include biometrics research and public and professional information activities. Aid to the States in developing community heart disease programs is given in cooperation with the Bureau of State Services of the Public Health Service. The National Heart Institute spearheads the total Public Health Service attack against heart disease, actively cooperating with other agencies and organizations in an accelerating drive.

The past few years have witnessed much progress. Advances in basic knowledge, in surgery, and in the development of drugs and techniques have strengthened hopes that the Nation's leading killer is not invincible. Yet the larger portion of the task remains. The underlying factors responsible for rheumatic, hypertensive, and arteriosclerotic heart disease—which account for 90 percent of all heart deaths—are still unknown. The search for the causes of these diseases and for means of controlling them, an expanding nationwide effort, may prevent much untimely death and disability in the not-too-distant future.

Apparatus for isolating biological materials, used in studying action of drugs

National Institute of Dental Research

Evaluation of dental efficiency as a variable in metabolic studies

The major dental problem of the Nation is dental caries, or tooth decay. Among children aged 15, over 95 percent have decayed permanent teeth, and the average child has lost two teeth from lack of treatment. The average adult will have lost half his teeth by the time he reaches 40.

Also extremely prevalent are diseases of the supporting tissues, called periodontal disease, of which pyorrhea is a major form. The prevalence increases with age, so that 85 percent of our population is ultimately afflicted with this baffling condition—the main cause of tooth loss in adults.

Malocclusion, or the incorrect relation of teeth or jaws to each other, is a serious problem in at least 1 out of 10 children. Harelip and cleft palate is a congenital condition occurring once in every 800 births. Other problems include oral cancer and the adverse effects of dental disorders upon general health.

The American people spend over a billion dollars annually for dental care, and many additional millions are spent for dental services to the Armed Forces, veterans, and other Federal beneficiaries. Not only do these expenditures promise no permanent solution to the Nation's dental problem, but adequate service is reaching only a third of our population.

The Public Health Service, looking toward the ultimate eradication of dental disease, approaches the problem through fundamental research and the development of preventive and control measures. Meanwhile, other aspects of the program are designed to further the application of present knowledge. The National Institute of Dental Research conducts and supports basic studies, with a view to improving the treatment and control of dental disorders. The problems mentioned above are subjected to varied but intensive attack.

Many of the projects derive from a discovery made in 1938 by National Institutes of Health workers, who showed that the element fluorine in drinking water, which was responsible for mottled enamel of teeth, can also give partial protection against dental caries. Determination of the concentration of fluorine that offers maximum protection without danger of mottled enamel, and the ruling out of harmful side effects, were further achievements of NIH workers. These results have led to fluoridation of public water supplies in over a thousand communities.

A long-term study begun in 1944 at Grand Rapids, Mich., has shown that fluoridation reduces tooth decay about 65 percent in young children. The extent to which the teeth of older persons are protected will be learned through further evaluation and the passage of time.

In addition to the Grand Rapids study, the National Institute of Dental Research is continuing laboratory experiments to learn more about the role of fluorine and its compounds in metabolism. What effect does fluorine have upon the body's utilization of other essentials? How is fluorine deposited in the body, and what is the capacity of

various bones to store it? Populations in regions of high natural fluoride levels are being observed for long-term effects. In a Texas community that had used water with eight times the recommended fluorine content, no adverse medical effects were detected over a 10-year period.

Besides these studies, the Institute staff, grantees, and fellows seek a better understanding of the normal structure of teeth and the various factors leading to dental disorders. Investigations are pursued in dental bacteriology, biochemistry, and biophysics.

For example, scientists at the Institute are exploring components of enamel and dentin with the electron microscope. It is thus possible to observe structural alteration on a greatly expanded scale. The pathways by which bacteria penetrate tooth substance can be studied and related to the breakdown of various tissue components.

The several types of bacteria associated with tooth decay and periodontal disease are also being investigated. Institute bacteriologists are developing techniques for the isolation and cultivation of these organisms, and are evaluating the use of antibiotics and other therapeutic agents. In another project the incidence of caries is compared in animals receiving processed and natural foods.

Cultivating bacteria from saliva of school children in fluoridation study at Grand Rapids

Electron micrograph showing bacteria in carious enamel, at 20,000 times actual size

Highly processed foods have been shown to increase tooth decay in experimental rats.

The research grants program of the Institute has contributed significantly to the knowledge of underlying factors in dental health and disease. It has been shown, for example, that artificial fever induced in pregnant rats causes dental malformations in the mother and offspring. In another study, a cancer-inducing agent, methylcholanthrene, changed the microscopic appearance of embryonic "tooth germs" to resemble that of malignant tumors. Of possible clinical significance is the discovery that the general health of individuals is reflected in the tissues of the mouth, suggesting a new approach to early diagnosis of disease.

Opportunities to extend fundamental knowledge in the field of dental health were substantially increased with the opening of the Clinical Center. Research projects of basic character are in progress or being planned. Among these are clinical studies on the effects of radiation on oral tissues, the use of therapeutic drugs in the oral cavity, the healing of wounds, development of neurological disorders of oral origin, treatments for malocclusion, the origin and treatment of periodontal diseases, and anesthetic compounds and techniques.

National Institute of Neurological Diseases & Blindness

No system of the human body is liable to permanent damage so quickly as the central nervous system. The surgical patient's heart that has been revived minutes after its beat has stopped may show no signs of damage, but once the circulation of blood and oxygen ceases, deterioration of the brain begins. After five minutes, so many brain cells have died that the patient will usually be permanently crippled.

Damage or destruction of sensitive tissues of the central nervous system or of the eye and ear results in some of mankind's most dreaded disorders—poliomyelitis, cerebral palsy, multiple sclerosis, epilepsy, muscular dystrophy, Parkinsonism, and many conditions causing blindness and deafness. These are among the 200-odd disorders that constitute the leading cause of permanent disability and the third cause of death in the United States. They are the research responsibility of the National Institute of Neurological Diseases and Blindness.

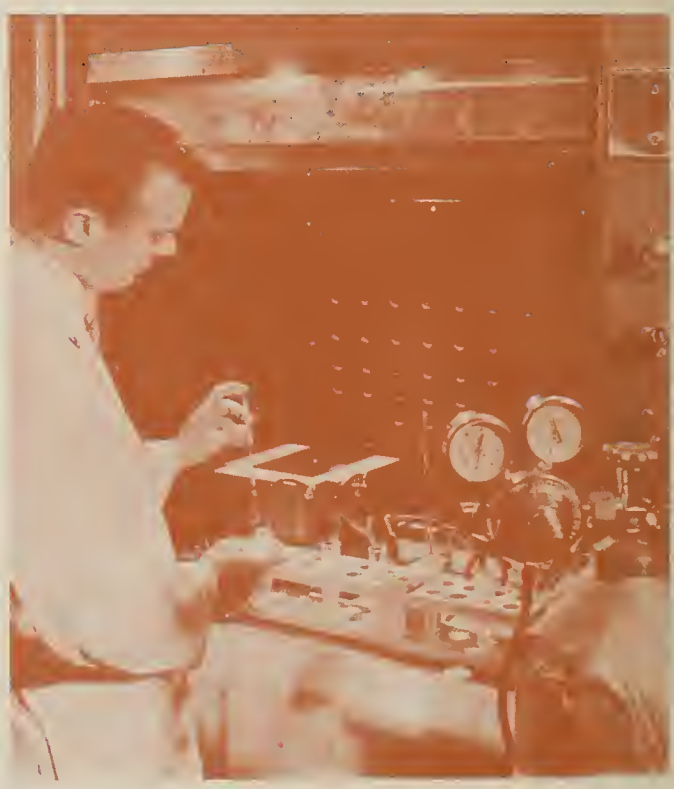
The research attack of the Institute is exceedingly varied. To understand the abnormalities that characterize neurological disease, and thus possibly to reverse them, the normal growth, activity, and functions of the nervous system must be defined. Science is therefore concerned with such problems as the physical and chemical nature of nerve cells, the means by which electrical energy is generated within them, and the ways that various cell areas combine to effect the body's activity. These studies are complex. The brain alone comprises more than four billion cells, each with a separate role in the processes of thinking, moving, seeing, hearing, and even digestion.

The attack on the neurological and sensory disorders focuses also on disease itself. So it is, for example, that research is dedicated to the development of new and better drugs for controlling epileptic seizure. So it is that studies are made into the causes of multiple sclerosis, cerebral palsy, cataract, and glaucoma.

The methods employed in such research vary considerably. Some investigators, such as the pharmacologists, attempt to create new antiseizure drugs by altering the structure of those already known to affect epilepsy. Others, the biochemists, compare epileptic and normal tissues in an effort to determine whether an insufficiency or excess of chemical substances underlies the abnormality. And in some instances, several specialties must coordinate in a single study.

This is true of a study on a blinding eye disease called uveitis, which is under cooperative investigation by the National Microbiological Institute and the National Institute of Neurological Diseases and Blindness. The former Institute is concerned with identifying the causative microorganism and creating uveitis in experimental animals; the latter, with developing more effective methods of diagnosis and treatment.

A study now under way in the Clinical Center illustrates a full coordinate attack on a medical



Collecting samples of sodium and potassium from muscle in research on neuromuscular disease

Instrument for recording electrical activity of single nerve cells in experimental animals

problem. One sample of muscle obtained from a patient with muscular dystrophy must be examined by a neuropathologist, who verifies the diagnosis; by a muscle chemist, who tests the contractile power of the sample; and by a biochemist and biophysicist, who employ radioactive tracers to measure components of muscle and blood. A neurologist and neurosurgeon also participate.

The discovery of a basic metabolic defect concerned with epileptic seizures will illustrate biochemical research in neurology. Animal and clinical studies at the Institute revealed an inability of epileptic brain tissue to retain glutamic acid, a substance essential to normal structure and function. Accordingly, glutamine and asparagine, natural substances closely related to glutamic acid, have been administered to patients. During these trials, previously intractable seizures have been wholly or partially controlled.

One of the most significant areas of neurological investigation concerns the regeneration of nerve tissue. Such chronic conditions as cerebral palsy and paraplegia are due to the destruction of tissue in the nervous system. If this destruction could be reversed, a successful treatment for several major disorders would have been achieved.

A decade ago, this objective would have been considered impossible. We are still not sure that it is possible; but within recent years, spinal cords severed in animals have been partially repaired through administration of an agent made from dead bacteria. This research affords substantial hope for further progress.

Many complications may present themselves. For example, even if nerve tissue, like any other tissue, can be made to regrow in humans, problems may arise such as how to control the growth so that the nerve fibers resume their natural positions and function. The solution may necessitate painstaking experiments concerning the origins and growth of the nervous system, now but little understood.

The quest for means of alleviating, controlling, or reversing the progress of neurological and sensory disorders has begun in earnest. The past decade has seen many major developments—new drugs for the control of epilepsy, Parkinsonism, and myasthenia gravis; new drugs and surgical procedures for cataract and glaucoma; and total rehabilitation as a means for the disabled to attain personal and economic adjustment. With the impetus lent to neurological science through the program of the National Institute of Neurological Diseases and Blindness, there is every reason to believe that these advances will continue.

Adjusting Warburg apparatus in determining ratio of oxygen to carbon dioxide in brain tissue

Clinical Center

The Clinical Center symbolizes the remarkable increase of public interest in medical research since World War II. Throughout the country, established research programs have expanded and new facilities and projects have been undertaken in universities, hospitals, health departments, and industry.

The Clinical Center is among the most recent of these ventures. Like most of the others, however, it consists largely of additions to an older program—new impetus, workers, and scope.

In response to a need long recognized in the Public Health Service, Congress in 1947 authorized the construction of a Center that would provide clinical study facilities and additional laboratory space at the National Institutes of Health. Construction was begun the following year, and the first patients were admitted on July 6, 1953. The full capacity of 500 patients and approximately 1,100 laboratory modules is not expected to be reached before 1957.

Antedating all scientific specialties, and more important now than ever before, is the study of health and disease in individuals. This is the science of clinical medicine as practiced since ancient times by physicians in homes and hospitals. To a great extent, medical knowledge has grown by just this process. In observing sick humans and attempting to restore their health, physicians are constantly acquiring new evidence concerning the causes of illness, and developing better methods of diagnosis, prevention, and treatment. Today this process of observation and discovery is accelerated by special research facilities such as the Clinical Center.

As the medical sciences have progressed, they have grown increasingly complex, and have thus become divided into scores of specialties. It has become apparent, however, that vital relationships exist among the physical, chemical, emotional, and sociological functionings of the human organism. If medical knowledge is to continue to advance, sharp lines cannot remain between various health problems and scientific approaches. Here is where clinical medicine, which concentrates on the whole man, serves its greatest research mission.

Another problem that the Clinical Center was designed to help solve is the need for increased use

Patients attend service in chapel, of which altar can be rotated for different faiths

In diagnostic X-ray department, preparations are made for radiography of heart and large vessels

of scientific tools and apparatus. Much medical progress has been possible only because of these aids. As they have grown in efficiency, they have become more complicated and expensive, and their operation requires more special training.

The Clinical Center was planned so that representatives of all the medical sciences could work together closely with clinicians, contributing not only to one another's research but also to the more effective treatment of patients. The Center was equipped so that every research tool needed by these workers would be available.

The division of space in the Clinical Center reveals its coordinating function. Each Institute has patient bedrooms and research laboratories in close proximity. The facilities for diagnosis, medical and nursing care, social service, rehabilitation, and recreation are comparable to those found in any good modern hospital. The laboratories are so designed that they can be readily modified to meet the changing requirements of research with a minimum of delay and expense.

As indicated on the accompanying floor plan, the patients' rooms are on the south side of the main portion of the building, directly across a corridor from the nursing services. On the north side of the main portion are the clinical laboratories, opening on another corridor. Thus, the scientists who deal directly with patients, studying them and providing necessary medical attention, are only a few steps from the patient area.

Scientists working on problems not directly related to patients are located in the wings, close to their clinical colleagues on the same floor. This horizontal arrangement, plus the elevators for vertical travel and a pneumatic-tube system, provide means for efficient, essential communication between workers.

The Clinical Center is more than a hospital. This is clearly illustrated by the way patients are admitted. Patients are received solely because they have a condition needed in a particular study by one of the seven Institutes sharing the Center. They must be referred by individual physicians or other qualified medical sources, after advance negotiations with the Center physicians. Hospitals, clinics, family physicians, and specialists in various diseases not only refer their patients, but through consultation, follow-up treatment, and observation, actively participate in the research.

Many studies depend upon the patients' remaining in the Center for long periods—often 3 or 4 months. After discharge, follow-up examinations or treatment may be given periodically for a few months to 10 years or more—a most important procedure in medical investigations. Special facilities for the comfort and morale of patients encourage them to stay for the entire time they are

needed and to return to the Center upon request.

As in every good hospital, the medical and surgical care received here is based on the ruling concept that the welfare of the patient has priority over all other considerations.

The methods of treatment employed are substantially the same as those accepted and used by well-qualified physicians everywhere. Far more extensive and frequent, however, are the laboratory tests and other examinations made for research purposes. Many patients are kept on precise diets, since a large proportion of the research projects require careful attention to metabolism. Special metabolic kitchens are maintained. There are also glass-enclosed rooms in which some patients are observed for days at a time, while the intake and output of nutrients and other substances are measured. A special wing is equipped for research and therapy using X-rays and other types of radiation.

Some of the studies under way in the Clinical Center are designed to evaluate promising drugs or methods of treatment. Other efforts are directed toward learning the basic causes of disease and the differences between disease and health. Still other research is concerned with the interrelations between various diseases, between different organs and tissues, and between the various chemicals produced in the body. All clinical studies are reinforced by fundamental laboratory investigation. Conversely, many laboratory investigations are stimulated and enhanced through the close relations maintained with clinical medicine.

Much of the above is summarized in six basic principles that have guided NIH in its clinical research program:

(1) The Clinical Center is a research center and not a medical care facility.

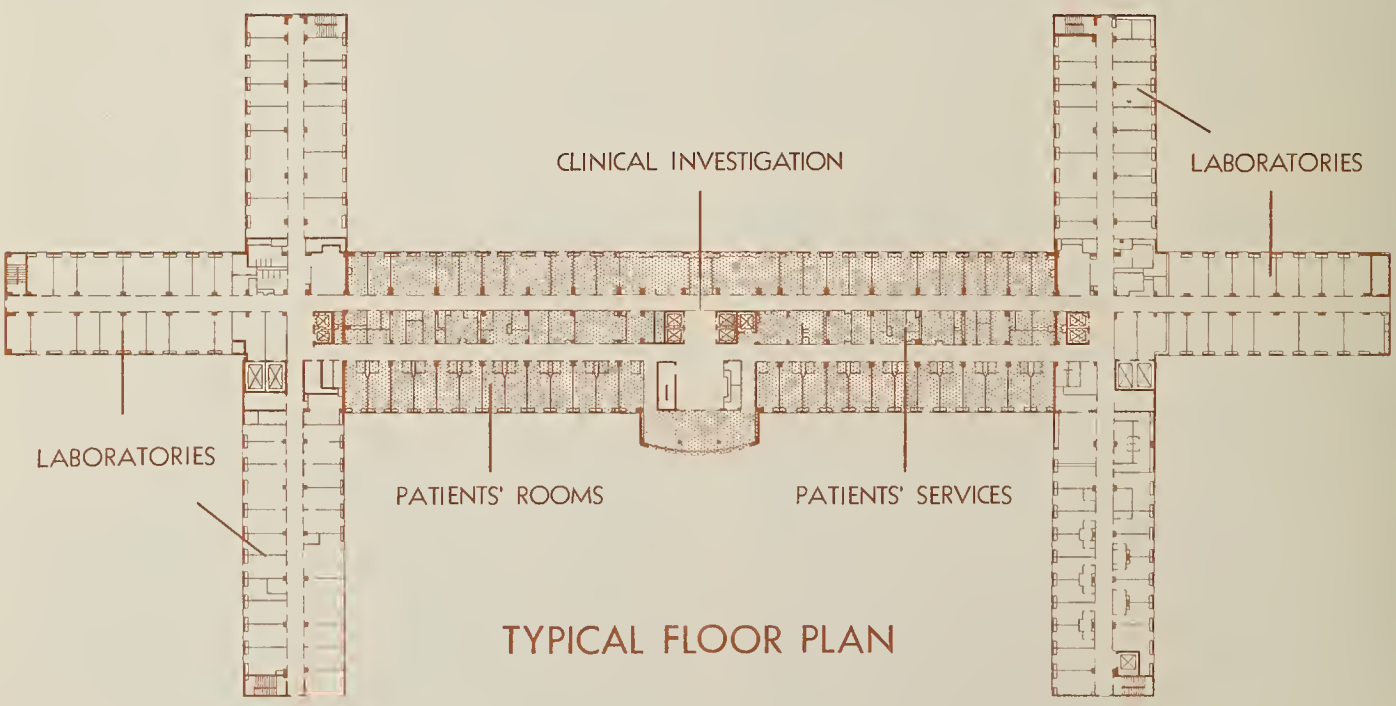
(2) Patients selected as research subjects are given medical care of the highest quality.

(3) The design and operation of the Center foster interchange of ideas and skills among all the major biological and medical specialties—basic laboratory, preclinical, and clinical.

(4) Resources of the Center are available for collaborative research by established scientists from other institutions, and opportunity is provided for able young clinicians to gain specialized training for independent careers in research medicine.

(5) In assembling the staff, every effort is made to minimize the impact on local medical and educational institutions.

(6) In obtaining patients for study, close collaboration is maintained with physicians, hospitals, medical schools, and clinics—the purpose being not to interfere or compete, but rather to permit medical practice, teaching, and research to proceed together in harmony.



TYPICAL FLOOR PLAN

Research Grants and Training

The program of the National Institutes of Health extends far beyond the research conducted in its own laboratories. Approximately two thirds of the funds appropriated to NIH support research and training in non-Federal medical institutions. Specifically, the disbursements consist of grants to support research projects, fellowship awards to develop research talent, traineeship awards to provide special clinical training, grants to promote control of disease, and grants to assist in improved teaching or training in certain medical areas.

In conducting this extramural program, the Institutes are aided by seven National Advisory Councils composed of citizens outstanding in medical science, education, and public affairs. The Councils review all applications for research, teaching, and training grants, and recommend appropriate action to the Surgeon General of the Public Health Service. He may award such grants only upon Council recommendation. The Councils also advise the Surgeon General on policy.

DIVISION OF RESEARCH GRANTS

The focal point of responsibility for administration of all research grant and fellowship programs at NIH is the Division of Research Grants. Its functions include receipt of applications, processing, assignment, payment, and auditing. In addition, the Division is fully responsible for the grants and fellowships in study areas not encompassed by the program of any Institute.

The major objectives of the *research grants program* are to expand research in medical schools, hospitals, and other institutions; to stimulate new investigation in neglected fields; and to provide training for scientific personnel. The grants support a broad spectrum of laboratory and clinical research in the medical and biological sciences.

To assist the National Advisory Councils, the Public Health Service has established within the Division a series of consultant groups known as Study Sections. These are composed of authorities in the major areas of research. Most of the members are nongovernmental scientists selected by the Surgeon General from all parts of the country. Members of the Study Sections and National Advisory Councils serve four-year terms, and the turnover is gradual.

To promote the highest quality of research, every effort is made to ensure the scientific freedom of the grantee. He is not required, for example, to follow the original proposal rigidly, but rather is free to pursue the project in whatever manner he wishes and to publish his findings without clearance with the Government.

The *research fellowships program* of NIH provides financial assistance to promising American scientists during their training period, so that they can enter careers in medical research and allied fields. These fellowships are awarded by the Surgeon General on a competitive basis upon the recommendation of scientific committees established by the Division. A research fellow may conduct his work at any institution where interests, guidance, and facilities are suitable. This program is an approach to the urgent problem of increasing the scientific manpower of the United States. Nine out of ten fellowship recipients remain in medical research after their training.

In addition to the regular fellowships, NIH awards *special research fellowships* which permit the mature scientist to gain, in the institution of his choice, further experience in a specialty. NIH also conducts a *visiting scientist program* by which prominent scientists participate in research at NIH for limited periods.

The national volume of medical research has grown substantially because of these extramural operations. Another major effect of the program has been to help stimulate research in neglected fields, particularly on some of the chronic diseases.

TRAINEESHIPS AND TEACHING GRANTS

Research manpower bears a crucial relation to the Nation's health. The quality and volume of medical research is directly proportional to the caliber and number of workers devoted to the medical and biological sciences. For the present, the Nation's competent medical investigators need more assistance. For the future, manpower shortages threaten to limit the acquisition of new knowledge, and the demands for scientific workers in all fields are steadily increasing.

Closely related to the problem of research manpower is the acute need for physicians with special competence in cancer, heart disease, arthritis, and other fields. Clinical research depends primarily upon physicians with advanced training.

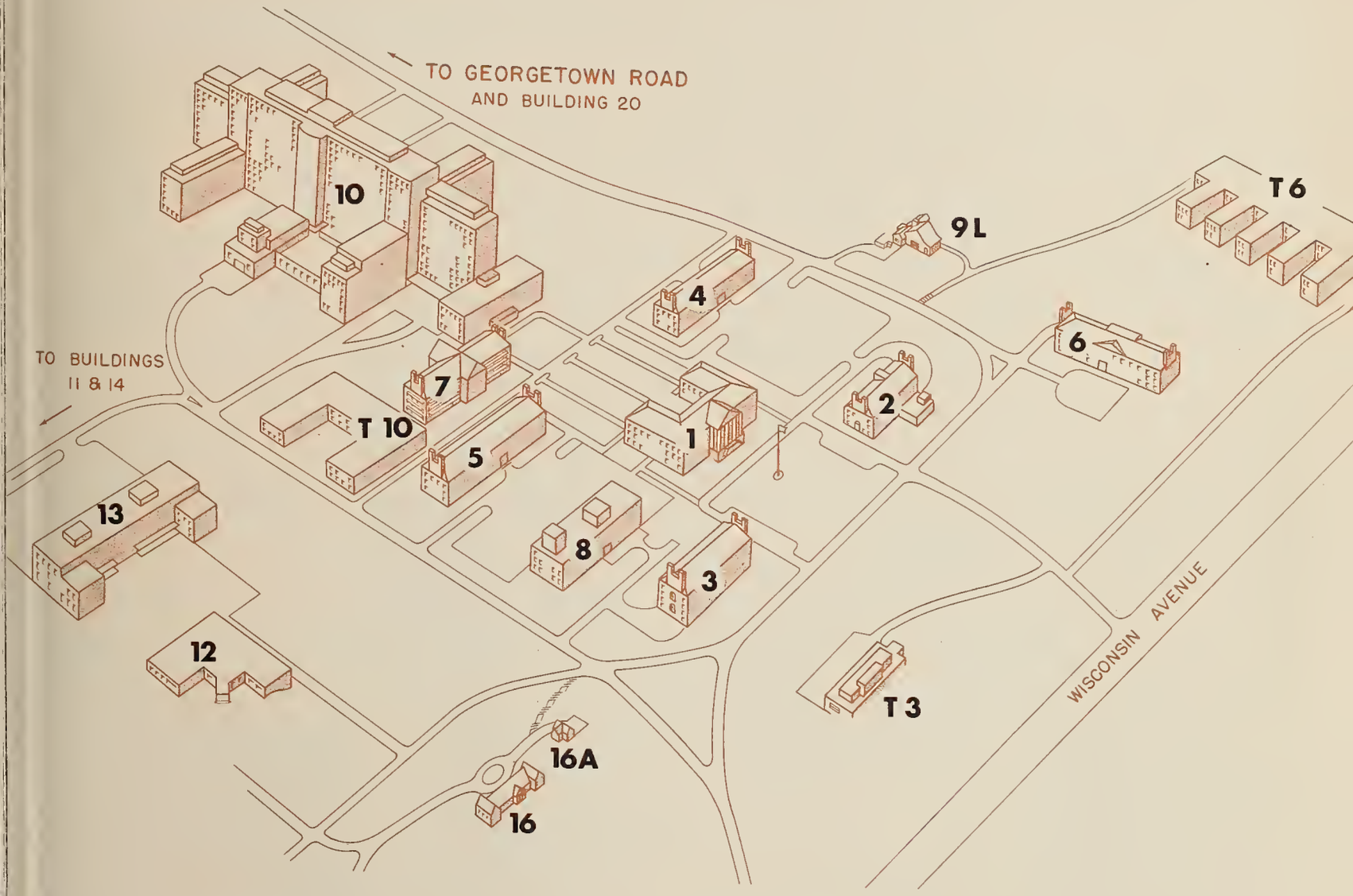
NIH, besides awarding fellowships, approaches these manpower problems through programs of two types. Several of the Institutes conduct *traineeship programs* to increase the number of physicians and certain allied workers engaged in specialized clinical practice. The essential difference between the traineeships and fellowships is that the former relate primarily to the practice of medicine; the latter, to medical research.

The *teaching* and *training grants* to educational institutions help equip medical students and professionals in certain related fields with the latest medical knowledge. This has been largely accomplished through the development of courses in the fields of heart disease, cancer, and mental illness. The cancer teaching grants, for example, have been extended to all the medical schools of the Nation.

Through its extramural programs, NIH contributes not only to the medical progress of today, but also to that of the future.

HOW A RESEARCH GRANT IS MADE

Directory of Buildings



1	Administration
2	Dental, arthritis, and metabolic research
3	Heart, arthritis, and metabolic research
4	Arthritis and metabolic research
5	Microbiological research
6	Cancer research
7	Memorial Laboratory (microbiological research)
8	Neurological, mental health, cancer research
9L	Top Cottage
10	Clinical Center
11	Boiler plant
12	General utility, storage
13	Shops, storage, laundry
14	Animal quarters
16	Stone House
16A	Offices
20	Apartment house (quarters)
T3	Isotope laboratory
T6	Offices (grants and fellowships, cancer, mental health)
T10	Neurological, mental health research

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